Gibraltar Point Erosion Control Project:

Phase 2 – Coastal Engineering Study and Detailed Design

Community Liaison Committee #1

March 24, 2010

GIBRALTAR POINT PROJECT

Conservation for The Living City

TORONTO

PRESENTATION SUMMARY

1. Project Update (TRCA):
   a) Review Role of Community Liaison Committee
   b) Review Results of Class EA
   c) Objective of Phase II Activities
   d) New Data Collected to Facilitate Phase II Activities
2. Coastal Engineering Results to Date (Baird and Assoc.)
3. Discussion (TRCA & Baird)
4. Next Steps (TRCA)
5. Other Business

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1. PROJECT UPDATE: ROLE OF CLC

Three **key functions** of the CLC:

a) To provide information and local knowledge to help inform the finalization of the preferred alternative and detailed design.

b) To identify issues of public and agency concern/interest during the analysis of the alternative methods for implementing the sand management plan and during the development of the Detailed Design.

c) To assist in the dissemination of information.

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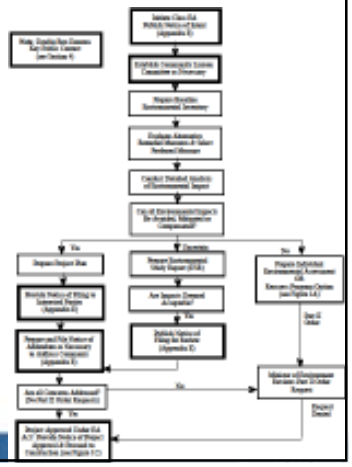
1. PROJECT UPDATE: REVIEW OF CLASS EA

CLASS EA COMPLETED

FINAL EA ACTIVITIES:

- Final draft of ESR released for CLC review (December 2007)
- Revisions to Project Description provided to CLC (January 30, 2008)
- ESR filed for 30 day review (February 16, 2008)
- Project approved under Class EA process (March 17, 2008)
- Authority Approval (May 23, 2008)

PHASE 2: DETAILED DESIGN & APPROVALS (initiated December 2009)



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1. PROJECT UPDATE: REVIEW OF CLASS EA

ESR DISCUSSION AND RECOMMENDATIONS

- Key Existing Conditions:
  - ESR estimated 20,000 m^3 of sand required per year
  - No naturally available supply of sand other than through local shoreline erosion
  - Western shore of Toronto Islands has one of the few remaining sand dune systems on north shore of Lake Ontario
- Preferred Concept: Sand management plan that recognizes some level of offshore protection may be required
- Purpose of Preferred Concept: Provide shoreline protection and to maintain natural dynamic backshore processes

1. PROJECT UPDATE: Objectives of Phase II

OBJECTIVES OF PHASE II ACTIVIES:

- Undertake detailed modeling to determine appropriate mix of active sand management (to minimize long-term operating costs) and offshore engineering (to minimize impacts to sand dune ecology).
- 5 approaches were identified to be modeled:
  - a strictly sand nourishment program, and
  - 4 arrangements of varying offshore protection features (varied by length of structure and by degree of emergence/submergence), each augmented by a sand enrichment program
- Select preferred alternative on the basis of ability to provide required shoreline protection and to allow for continued sand dune processes
- Proceed to detailed design of the preferred alternative including required permits and federal approvals

1. PROJECT UPDATE: Preferred Concept Elements

Conservation Ontario

1. PROJECT UPDATE: Preferred Concept Elements

Justification

- Funding available through capital works budget;
- Segmented breakwater reduces amount of sand required, which is beneficial given unconfirmed long-term source of funding; and
- Segmented breakwater provides measure of safety should funding for sand management be reduced/denied in a future budget year(s)

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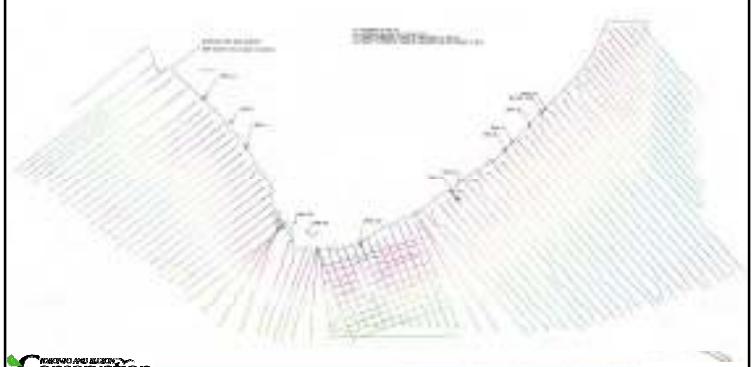
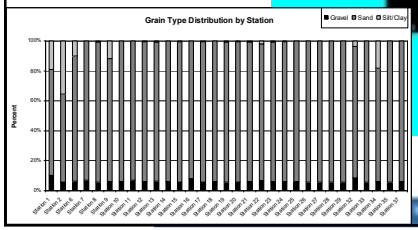
1. PROJECT UPDATE: Data Collected in 2009

BATHYMETRY



1. PROJECT UPDATE: Data Collected in 2009

Sediment Surveys



2. Coastal Engineering Update

(Switch to Baird Presentation)

3. Discussion

KEY TOPICS FOR DISCUSSION:

a) Class EA results and intervening period
b) Questions regarding coastal and shoreline processes along the Great Lakes
c) Update to the existing conditions
d) Modeling approach & results
e) Implications of alternatives being recommended
   - Survivability of structures
   - Maintenance and operation requirements
   - Impacts on sand dune ecology
   - Recommendations
e) Other issues

4. Next Steps:

1) **Finalize modeling and write-up**
   - **Limitations of modeling;**
   - **Characterizing performance of options;**
   - **Sand management considerations (estimate frequency, sources, and placement)**
2) **Develop cost estimates**
3) **Present matrix of advantages and disadvantages**
4) **Final selection and confirmation of preferred**
5) **Initiate CEAA Screening process**
6) **Design development and detailed design of preferred alternative**
7) **Produce final drawings and specifications**

5. OTHER BUSINESS

1) **City of Toronto:**
   - **Toronto Islands Sand Dune Protection and General Landscape Improvements**
2) **Others**

Toronto and Region Conservation for The Living City

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GIBRALTAR POINT PROJECT

GIBRALTAR POINT PROJECT

Gibraltar Point Erosion Control Project:
Phase 2 – Coastal Engineering Study and Detailed Design
Community Liaison Committee Meeting #2

Chair: Kenneth Dion

Wednesday June 16, 2010
1:00 p.m. – 4:00 p.m.
Artscape Gibraltar Point Retreat Centre, Toronto Islands

MEETING SUMMARY

Meeting purposes:

- To provide an overview of existing conditions at Gibraltar Point
- To summarize two short-listed design alternatives:
  - stand alone sand management; and
  - 550m long breakwater with groyne and reactive sand management
- To analyze and compare pros and cons of the two alternatives
- To present preliminary recommendation of preferred alternative
- To receive questions and seek comments from the CLC

Key Outcomes:

- Stand Alone Sand Management identified as being less practical and poses a higher risk. Cost of this alternative is estimated to be $13,000,000 (present value) assuming 3% discount rate, or $505,000 per year for 50 years.
- 550m breakwater, groyne and sand management has greater stability while protecting Gibraltar Point from erosion. Cost of this alternative is estimated to be $13,500,000 (present value) for 50 years, assuming 3% discount rate and 0.5% annual maintenance.
- Meeting summary and ppt presentation will be provided to CLC members to provide comment and review more fully.

Members Present:

Bill Snodgrass	City of Toronto, Water
Dave Fleming	Hanlan's Beach Naturist
Gary Stinson	City of Toronto, Water
Halina Bregman	Island Resident
Janette Harvey	City of Toronto, Parks, Forestry and Recreation
Jenny Bull	Island Resident
Jim Allan	Toronto Field Naturalists
Joanna Kidd	
Mary-Louise Byrne	Wilfrid Laurier University
Robin Davidson-Arnott	University of Guelph
Steve Varga	Ministry of Natural Resources

Staff and Consultants Present:

Jinho Lee	Toronto and Region Conservation
Ken Dion	Toronto and Region Conservation
Mark Kolberg	Baird and Associates
Mohammad Dibajnia	Baird and Associates
Thomas Sciscione	Toronto and Region Conservation

INTRODUCTIONS

Ken Dion (KD), Senior Project Manager, TRCA, welcomed and thanked the participants for attending the meeting. Everyone introduced themselves and their affiliation to this project.

1.0 SUMMARY OF SHORELINE EROSION AT GIBRALTAR POINT

KD indicated that the conclusion of the first CLC meeting resulted in the selection of two alternatives to be considered in more detail as a solution to control erosion at Gibraltar Point and maintain sand dune processes at Hanlan's Beach:

- Stand-alone sand management approach – requires the annual placement of sand at Gibraltar Point to offset shoreline erosion; and
- Structural protection works with a sand management program – requires a 550 m breakwater, a 130 m long partially submerged groyne with a reactive sand management. In this scenario, the breakwater prevents wave attack of the shoreline at Gibraltar while the groyne reduces currents from transporting sediment east to west. The sand management program is reactive, meaning that sand is placed only when required (in much smaller volumes than the straight sand management approach) to ensure current volumes of sand retained at Hanlan's Beach and dunes.

The main purpose of the CLC #2 meeting is to go into greater detail for the two remaining approaches and present a comparative analysis of the two designs.

Q: Can we have the power point presentation sent to the CLC members?
A: Yes.

2.0 REVIEW OF SELECTED DESIGN ALTERNATIVES

Mohammad Dibajnia (MD) presented the summary of the shoreline erosion at Gibraltar Point and two alternatives.

He indicated that the major area of concern is between Hanlan's Point and Gibraltar Point where majority of the erosion has been occurring over the years. Currently, the erosion at Gibraltar Point is supplying sand to the Hanlan's Beach located northwest of Hanlan's Point that has sand dunes and other environmentally sensitive areas. The environmentally significant wetlands and fish ponds shoreward of Gibraltar Point are being threatened.

MD used past bathymetry surveys from 1981, 1993, 2005 and 2009 to illustrate the eroding trend at Gibraltar Point (about 100 m of retreat of profile occurred between 1981 and 2009) and sand deposition at Hanlan's Beach.

Between 1951 and 2010, he estimates that the shoreline eroded between Gibraltar Point and Hanlan's Point at a rate of approximately 4.3 m per year.

Comments (C): Comments were raised regarding the approach used to calculate erosion rates.
Response (R): Baird will review and revise as appropriate. It was agreed that erosion rates varied between 3 and 5m per year over this period of time.

Assuming an annual erosion rate of 4.3 m per year, the estimated shoreline configuration was interpolated for the next 25, 50 and 100 years if no action were taken to address the erosion at Gibraltar Point. MD indicated that within 25 years, the most productive wetland fish habitat in the Inner Harbour will be breached to the open lake. The erosion would also result in the need for new roads and bridges and the loss of park space on the Islands. Assuming the intake groyne and the end of the airport runway remain, it is anticipated that the shoreline will stabilize sometime between 50 to 100 years but that the majority of the sand dunes, their plant communities and Hanlan's Beach will be lost prior to reaching stability. The Water Filtration Plant would also likely be at risk at some point during this period of time.

It was estimated that erosion of Gibraltar Point area provides about 14,000 m^3 to 18,000 m^3 of sand per year, with the majority of sediment transported and deposited towards the northwest along Hanlan's Beach, with approximately 3,000 m^3 per year reaching the Western Channel.

Question (Q): Can we say that the island is stable? Or is sediment just being transported from one place to the other.
Answer (A): In terms of sediment mass balance, it can be stated as being dynamically stable. Relatively minor losses occur through aeolian (wind) processes to the dunes and longshore transport into the Western Channel, however, the majority of sand deposits along Hanlan's Beach and under water, offshore. However, in terms of the visible part of the Island above water, it can be said that it is not stable. The loss of material to theoffhores poses significant challenges of "collecting" sand locally on an annual basis to stop real erosion at Gibraltar Point.

C: Having these values is a great asset to this project. Previously, there was assumption that the sand is being lost but actually it is contained within the island.
A: Sand its contained within the island <u>and its nearshore area</u>. In other words, while the total volume of sand is conserved, the total area of the island above water is changing as the eroded sand is partly settled underwater.

Q: Will the accumulation of sand at Hanlan's Beach protect the beach during storm events?
A: To some extent yes, but the protection is less effective against larger storms.

3.0 ANALYSIS OF THE SELECTED ALTERNATIVES

The Design Objectives were reiterated:

- Control erosion of Gibraltar Point
- Mitigate the impacts on natural processes at Hanlan's Beach

Alternative #1 approach focuses only on Sand Management that would replenish the sand lost through erosion by placing "new" sand in the eroding area. Sand management would be required on an ongoing basis to be prepared for upcoming storm events and their sequencing.

Using a computer model for longshore sediment transport (LST) and hindcast data of 40 years of wave climate, Baird calculated the potential sediment transport rates along Gibraltar Point. Potential transport assumes loose unconsolidated sands are available to be transported by the wave energy across the entire nearshore profile. Based on the potential transport rates, Baird estimated that on average approximately 30,000 m^3 of sand would be required offshore of Gibraltar Point every year and that this value could vary between 15,000 m^3 and 60,000 m^3 depending on the weather conditions during any given year.

MD identified that approximately 800 m^3 of sand can be dredged per day [**NOTE** – Dredge rate mentioned was for 8 hr/day from a local site. Typically, dredge operation might run 24 hrs/day with a daily production rate of about 2000 m^3/24 hr day for a hydraulic dredge.]. To dredge 30,000 m^3 of sand, it will take approximately 37 days at 8 hrs/day or 15 days at 24 hrs/day. He also indicated that the use of the beach and the shore would restrict public use during the process.

> *Q: Is there sufficient sand deposits northwest of Gibraltar Point that can be used to concentrate dredging activities?*
> *A: There is currently about 60,000 m^3 of sand available at the Western Channel. However, this only represents about 2 years of supply for the full sand management approach with replenishment rates in the order approximately 3,000m^3 per year. There are sand sources at the harbour entrance to Ashbridge's Bay and Coatsworth Cut and off the Eastern Beaches. But the cost of retrieving the sand and transporting it to Gibraltar Point would be higher and there are expectations that sand material in these areas be used for local bypassing/renourishment efforts.*
>
> *Q: In 1975 the City built a beach at the east end of the Toronto Islands by dredging the Eastern gap. What was the volume of sand collected there? Is there sand in the Eastern Gap that can be used for Gibraltar Point?*
> *A: Baird will look into that answer to confirm the amount dredged in 1975. There isn't a source of readily available sand in the Eastern Gap for continuous, lon-term use at Gibraltar Point.[Note: According to the 1994 Toronto Islands Shoreline Management Study Report of Coastal Processes (Baird), the Eastern Channel was dredged in 1983, which was the first time since 1965. The dredge volume in 1985 was 28,500 m^3 and it was dumped offshore.]*

Q: What kind of materials are present further out from the shore?
A: Evidence from aerial photographs and reports by TRCA fisheries staff is that it is a very hard glacial till with bedrock that will not erode easily.

Q: Can sediment from the Keating Channel be used?
A: Currently, sediment is dredged from the Keating Channel at a rate of approximately 35,000 m^3 per year. However, using current technologies, the sediment does not meet open lakefill guidelines, though technologies proposed for the Don Mouth Naturalization and Port Lands Flood Protection Project may allow for the reuse of some of those materials in the future. However, the sediments at the mouth of the Don consist of silts and sands, and are not representative of the grain size distributions that exist off of Gibraltar Point. [NOTE – Baird will compare grain size distributions between Keating Channel and the Gibraltar Point to assess appropriateness of the materials for reuse.]

MD identified an option of placing a permanent sediment pumping station near the Western Channel that would replenish the sediment lost at Gibraltar Point, but the system requires a steady supply of sand. A fixed station is not flexible and this approach was not considered viable because only 3,000 m^3 per year is deposited at the Western Channel.

MD stated that alternative #1 Sand Management would cost approximately $13,000,000 present value to manage erosion control for 50 years, assuming a 3% discount rate. The discount rate is based on the difference between the anticipated interest rate and the rate of inflation. In other words, if the full $13M was put into a "bank account" today, it would be sufficient to pay for the annual and Management operations over the next 50 years. The up front costs for financing this approach vary greatly from $15,800,000 assuming a 2% discount rate, and $10,800,000 assuming a 4% discount rate. These costs are based on the assumption that all sand can be obtained locally using a hydraulic dredge system. These costs increase if sand requires barging from other locations along the waterfront, river mouths or excavated from aggregate sources like the Oak Ridges Moraine.

Alternative #2 relies on an engineered structural feature to control erosion of Gibraltar Point. This includes the construction of an emerged 550 m Detached Breakwater, with a 130 m long, partially submerged groyne and a reactive sand management program. The breakwater will protect the shore from waves that erode the shoreline and the groyne will stabilize and promote deposition of sediment at the beach located east of Gibraltar Point. Focused sand management is then also required to replenish the small average annual loss of beach material that would occur at Hanlan's Beach northwest of the breakwater.

Q: What are the dimensions of the groyne?
A: It extends out to the 2.5 m below chart datum contour and is about 130 m long from the shore. The groyne can take the form of a wall (which would be very thin) or it can be constructed with armour stone, which would result in a base width in the order of 8 m. This would be determined during the detailed design. For discussion purposes, assume

that the shoreward half of the structure length would be emergent (above water) with the lakeward half of the structure submerged.

Q: How wide is the top and base of the breakwater?
A: The width at the top can range from 3 m to 7 m and crest elevation would be about 2.5 m above chart datum. Chart datum is elevation that the water level typically does not go below; for Lake Ontario, Chart Datum is 74.2 m. Chart Datum is not the lowest water level recorded (that is about 73.5 m). As such, the top of the breakwater would be at an elevation of about 76.7 m. The base of the breakwater would be at the 3.5 m below chart datum contour and would possess a base width of approximately 25 m wide (assuming a crest width of 7 m). Again, the final details would be defined during detailed design. With the breakwater located 250m or more offshore, its low profile will not present a significant visual impact from shore.

Using COSMOS, numerical computer modeling of sediment transport on Hanlan's beach was performed. The simulated results indicate that Hanlan's Beach will loose approximately 3,000 m^3 per year of sand to the Western Channel and will be required to replenished. This reactive sand management is on the order of 3,000 m^3 per year; due to the relatively small average annual volume, the sand could be replenished once every 3 to 5 years (9,000 m^3 to 15,000 m^3), or following particularly large storm events. This will maintain Hanlan's Beach to its current configuration, and will allow for dynamic sand dune processes to continue. The present growth of Hanlan's Beach would not continue.

If no sand management is practiced, the shoreline will gradually erode before becoming stable in approximately 50 years after about 150,000 m^3 of sediment has eroded away. Hanlan's Beach would continue to exist, though with a smaller footprint and coarser grain sizes.

Q: Does the stability include the loss to aeolian transport?
A: As the fine sediments are lost through wind and currents, and in the absence of resupply, the beach will consist of coarser materials. The dunes will not disappear, but will stabilize with new plant communities growing on them.

MD indicated that dredging to replenish the eroded sand does not need to happen every year. For example, 15,000 m^3 can be placed on the beach every 5 years.

With Alternative #2, it would cost approximately $13,500,000 present value to manage erosion control for 50 years, assuming a discount rate of 3% and an annual maintenance of 0.5%. Unlike Alternative #1, most of the cost will require upfront payment for infrastructure and is less sensitive to variations in the discount rate. For example, assuming a 2% and 4% discount rate, upfront costs would only vary from $14.2 M to $13.1 M. Also, given that only approximately 3,000 m^3 of sand are required on an annual basis, and given that approximately 3,000 m^3 are available at the Western Channel every year, sands can be derived entirely from local sources on a long-term basis, eliminating the cost escalation factor that would be required to transport sediments long distance from other sources.

4.0 COMPARISON OF THE SELECTED ALTERNATIVES

MD stated that Alternative #1 has higher risk of not being successful and is less practical because of the following:

- Operation and maintenance – since it's impossible to know exactly how much sand is required annually to supply the sediments, worst case scenario must be taken into account by continuously having 30,000 m^3 or having the capacity to provide up to 60,000 m^3 at a relatively short notice. Given the amount of time required to dredge ~30,000 m^3 per year using a hydraulic dredge system - ~37 days at 8 hrs/day (or 15 days working 24 hrs/day) are required. To avoid winter season, prime beach-going season, and fish timing windows, all construction must be completed essentially between Labour Day and early October.
- Sand Source – multiple sources of sediment would be required after the first couple of years of operations. Additional costs for offsite sources have not been calculated but would be significant. Offsite sources of sediment also raises the issue of introducing different grain sizes and/or invasive species to Gibraltar Point as well.
- Cost – uncertainty about future budgeting due to additional transportation costs, and current City budgeting procedures. Costs will most likely increase beyond $505,000 per year.
- Public Perception – negative response may be received due to ongoing costs and open ended solution.

C: There is high chance that the sediments that are brought will have different grain sizes to the existing sediments at Gibraltar Point. This may cause risk of alternating rate of erosion and deposition and also impact the quality/function of the existing sand dunes.

C: The growing demand for sand/aggregate sources for construction (highways, buildings, etc) will make sand for beach nourishment a much more expensive commodity. The cost estimates presented for sand management significantly underestimates the future costs of obtaining suitable sand sources.

Alternative #2 with breakwater, groin and reactive sand management offers:

- Lower risk of failure than the straight sand management approach.
- Less certainty regarding adverse impacts on a local scale (i.e., directly adjacent to the breakwater structure).
- Less operational issues regarding length of time required for beach nourishment and available operational windows.
- An entirely local source of sand for replenishment of Hanlan's Beach,
- Stabilization of the beach east of Gibraltar Point,
- Potential creation of additional public spaces (if the City so desires; Note that cost estimate does not include cost of this potential additional public space); and
- Can be funded by existing City budget processes.

Q: Do you have to get a permit to do dredging every year?

A: A meeting with DFO is scheduled to discuss this project. Dredging will be on the list of discussions. [Dredging would be covered as part of the CEAA Screening process]

Q: Have you considered the aesthetics and public perception of a breakwater/groin system?
A: Yes we have, and we will add that as a specific criterion in the evaluation tables based on the degree of visibility from shore.

C: Operational dredging windows needs to be included in the criteria as well. There are only specific times in a year the dredging can be performed. Alternative #1 will require on average 37 days (8 hrs/day; or 15 days at 24 hrs/day) annually to fulfill the requirements; Alternative #2 will only take one-tenth the time, if done annually, or one-half the time if done every 5 years. The seasonality of when storms occur compared to when dredging can occur in a straight sand management approach is also a major limitation to that approach.

C: More accurate way to show the duration of dredging process will be provided.

C: Cost of the Alternative #2 is more certain compared to Alternative #1 because the majority of the cost for alternative #2 goes to the construction of the breakwater and groyne while Alternative #1 may vary year to year depending on the conditions.

Q: It was indicated that the potential sediment transport of 30,000 m^3 per year came from using computer numerical modelling analysis. Do we have some idea of the sensitivity of that? For example, do you use single friction factor or do you vary it from location?
A: Uniform friction factor has been used for calculation of nearshore currents. The selected value was based on our experience from previous model applications and previous comparisons with field measurements. For calculation of sand transport rates under waves and currents, the friction factor is directly calculated and varies with in space depending on water depth, current intensity and sediment grain size. Final results are not expected to be very sensitive to the choice of currents friction factor. Model results agree reasonably well with our volume estimates from GIS analysis and reported losses to the Western Channel and this is a strong indication of their applicability.

C: There seems to be a lot of uncertainty in terms of quantity of sand being eroded and what is required.
A: The values that were presented today are the most accurate to date using the best information available..

Q: Why did you use COSMOS to calculate the long term transport with breakwater and groyne?
A: In order to simulate how much material might be eroded from the upper beach at Hanlan's Beach we have to use COSMOS. COSMOS can calculate beach

profile evolution for given wave and water level conditions considering wave setup and runup processes. HydroSed does not have beach erosion capabilities.

C: There is flexibility of placing 30,000 m^3 of sand every year because erosion and deposition rate vary year to year.

C: It would be nice in future meetings to have the meeting package prior to the meeting. It would be wise not to make final decision on this meeting. We should go through the material provided today and provide comments.

5.0 CONCLUSION

Alternative #1 would require on average 30,000 m^3 of sand annually but the actual amount of erosion is impossible to predict. 60,000 m^3 of sand needs to be available on stand by for worse case scenarios. Approximate cost is $13,000,000 (present value) assuming 3% discount rate, and an average annual cost of $505,000 per year, assuming usage of local hydraulically dredged sediments.

Alternative #2 would protect shoreline at Gibraltar Point, stabilize the shoreline to the east of Gibraltar point and minimize the impact on natural process at Hanlan's Point. Approximate cost is $13,500,000 (present value) assuming 3% discount rates, 0.5% annual maintenance, and local hydraulically dredged sediments.

MD stated that Alternative #1 has greater uncertainty and higher risk.

6.0 QUESTIONS AND DISCUSSIONS

Q: 550m breakwater seems like long, can we reduce the size?
A: In the EA, the length of the proposed breakwater was 750 m to 900 m. Our simulation shows it is not necessary to have a breakwater that long. 550 m is the minimal length required to provide protection to the shorelines. In the EA the design included a curved design but the simulation showed it is not necessary.

Q: What would this do to development of new beaches on the island? Will there be added beach space?
A: It could improve the current Gibraltar Point Beach. With additional upfront beach nourishment there could be increased beach space behind the breakwater. [Follow-up: The focus of the Class EA is not to create new beaches. That would need to be a City-led initiative].

Q: Does the cost of alternative #2 include the creation of the beach space?
A: No, this cost is not part of the project as this is not an objective of the Class EA. A cost estimate could be provided as a separate project for consideration.

Q: How will the breakwater affect water quality?
A: There remains a significant gap between the breakwater and groyne, allowing for continued water movement to occur – it is expected that water quality will not deteriorate.

C: Water quality should be included in the criteria and risk list.

C: Include the potential risk associated with breakwater and groyne which will result in less sand moving through the system and the impacts that it may have to the sand dunes and plant communities.
R: As long as there is sand on the beach and wind blows the sand, the plant communities and the dunes will continue to be present.
R: Key things that affect the sand dunes and vegetation are: wind, water fluctuations, wave climate – these three factors will not change, therefore significant changes to the dunes and vegetation will not occur. Potential risk is the reduced wave action on Hanlan's Beach caused by the breakwater that reduces the areas sand could supply the dunes; but the simulation model shows this will not occur.

Q: There is a 50 year time estimate of the breakwater and the groyne, what is a lifespan of a break wall?
A: Final designs will determine the lifespan; the lifespan used for analysis of the options is 50 years, but the structures can last for longer than 50 years.

C: The visual impact of the breakwater is a concern.
C: This will be included in the evaluation of risks/criteria.

7.0 NEXT STEPS

The meeting notes will be provided with the presentation. Questions and recommendations will be followed up on and included in the meeting notes. CLC members are asked to review and provide any comments on the content by Friday July 9, 2010.

Meeting concluded: 4:00 pm

Gibraltar Point Erosion Control Project

Phase 2 – Coastal Engineering Study and Detailed Design

CLC Meeting #2
Wednesday June 16, 2010
Toronto Islands

Outline

- Summary of shoreline erosion at Gibraltar Point
- Review of selected design alternatives
- Analysis of the selected alternatives
- Comparison of the selected alternatives
- Conclusions
- Questions and discussions

Review of Shoreline Erosion at Gibraltar Point

Key Map

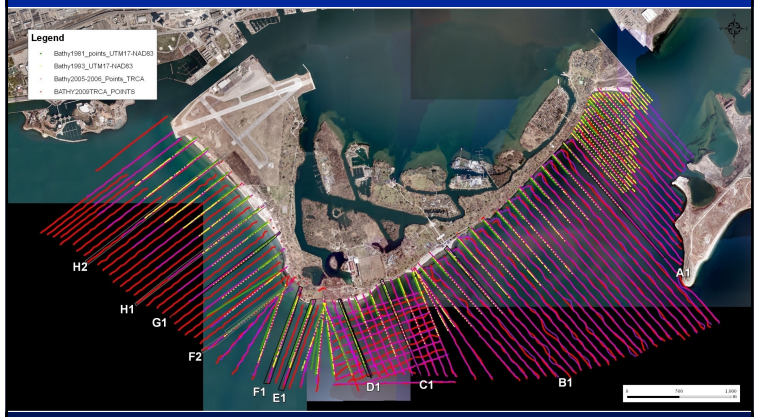
Shorelines Since 1913

Baird *Navigating New Horizons*

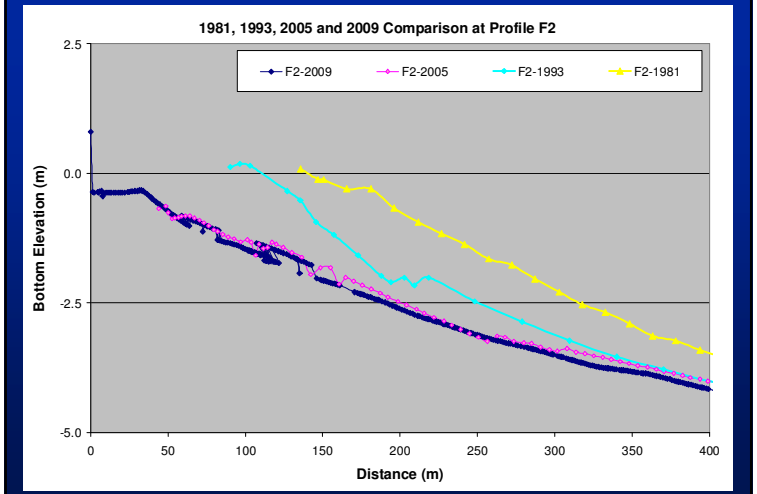
Existing Ecosystems

Baird *Navigating New Horizons*

Bathymetric Surveys

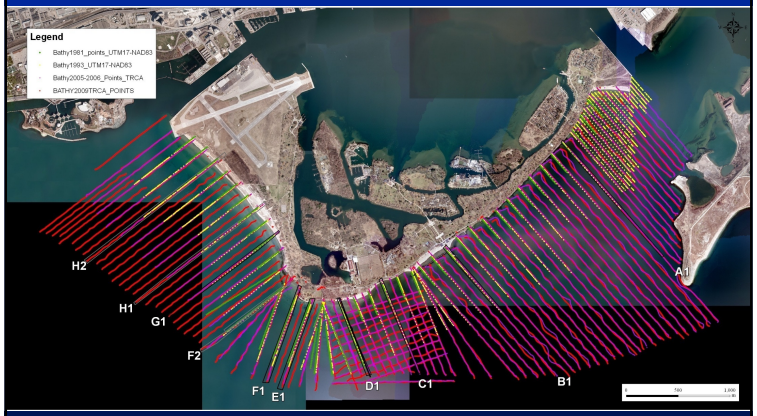


Baird *Navigating New Horizons*

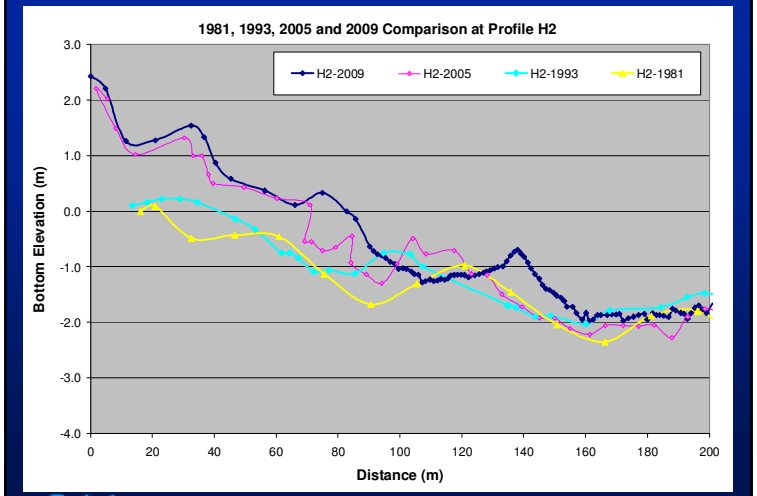


Baird *Navigating New Horizons*

Bathymetric Surveys



Baird *Navigating New Horizons*



Baird *Navigating New Horizons*

Shorelines Since 1913

Baird *Navigating New Horizons*

Recession Rates at Transect A

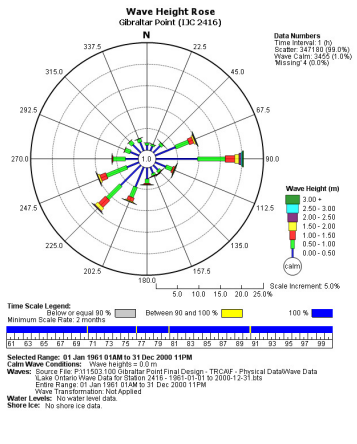
Time Period	Recession Length (m)	Years	Annual Rate m/yr
1951 to 2009	200	58	3.5
1954 to 2009	148	55	2.7
1967 to 2009	154	42	3.7
1978 to 2009	118	31	3.8
1981 to 2009	130	28	4.6
1989 to 2009	119	20	6.0
1993 to 2009	84	16	5.2
1999 to 2009	43	10	4.3
2007 to 2009	11	2	5.4
		Average	**4.3**

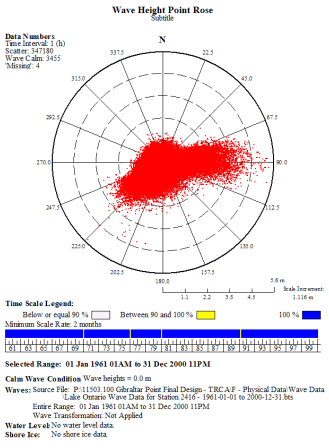
Baird *Navigating New Horizons*

Projected Future Shorelines

Erosion Processes at Gibraltar Point

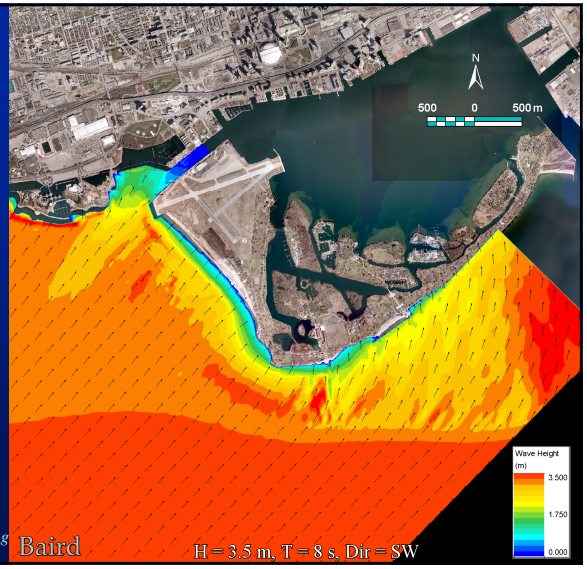
Wave Roses (WAVAD Point 2416)

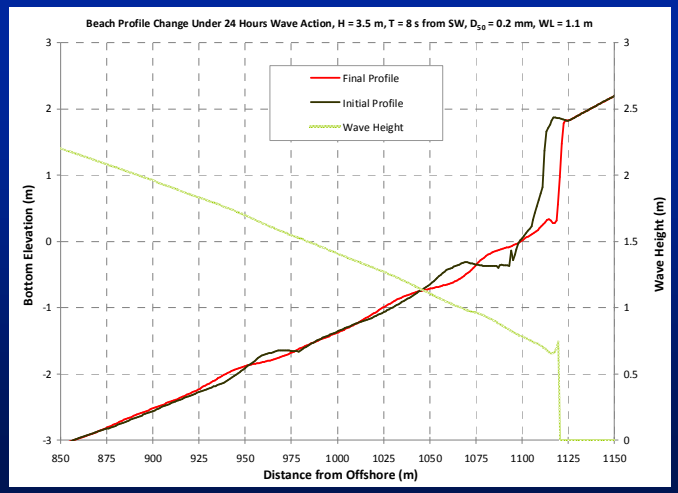




Wave Height

3.5 m,
8 s,
SW

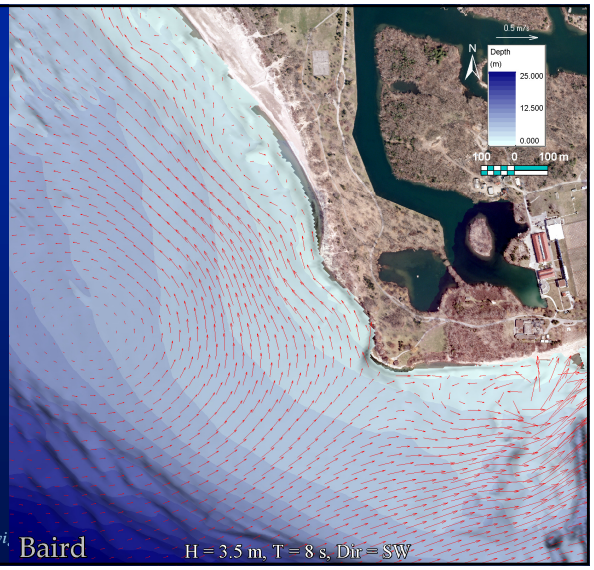




Baird *Navigating New Horizons*

Nearshore Currents

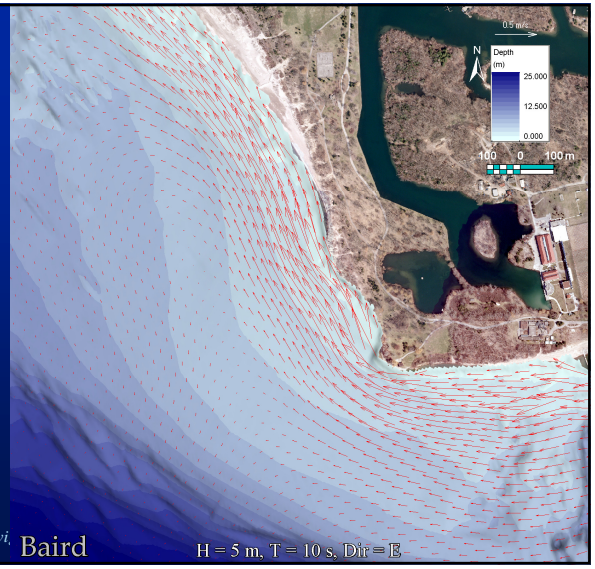
3.5 m,
8 s,
SW



Baird *Navi*

Nearshore Currents

5.0 m,
10 s,
E



Baird *Navi*

Coastal Processes at Gibraltar Point - Summary

Baird *Navigating New Horizons*

Erosion Volumes at Gibraltar Point

1980-2009 Shoreline Comparison

1999-2009 Shoreline Comparison

Area Calculations

Area:

Accretion: 3,190 m^2/year ~ 15,950 m^3/year

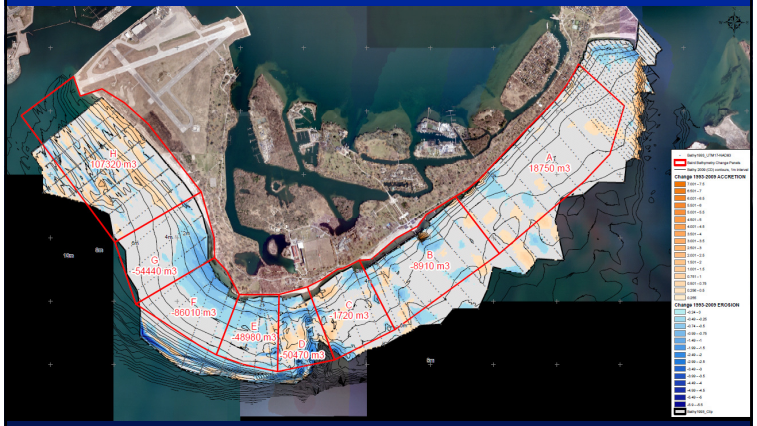
Erosion: 2,024 m^2/year ~ 14,170 m^3/year

Profile height: 5 m in accretion area (HB)

7 m in erosion area (GP)

Simplified approach

1993-2009 (16-year) Bathymetry Comparison



Baird *Navigating New Horizons* Out to 6 m depth contour

Volume Calculations

Volume:

Accretion: 10,100 m^3/year

Erosion: 18,600 m^3/year

Effect of survey inaccuracies over a large area resulting in overestimation of erosion.

Neglect of wind blown transport resulting in underestimation of accretion.

Sediment loss into the Western Channel (~ 2,000 m^3/year)

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Summary

- Erosion at GP (shore and lakebed) provides on average about 14,000 m^3 to 18,000 m^3 of sand to the littoral system each year, most of it is transported to northwest and deposited on Hanlan's Beach.
- Erosion is expected to occur mostly during severe SW storm events. Material is transported to northwest during both southwesterly and easterly storm events.

Baird *Navigating New Horizons*

Selected Design Alternatives

Baird *Navigating New Horizons*

Design Objectives

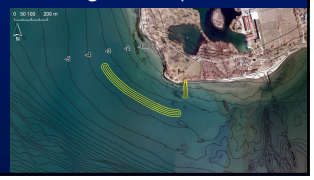
- Control erosion of Gibraltar Point.
- Mitigate the impacts on natural processes at Hanlan's Beach.

Alternative #1 - Sand Management

- A pure sand management approach would have to compensate for eroded sand volume from Gibraltar Point every year.
- Sand management would be required on an ongoing basis to be prepared for upcoming storm events and their sequencing.
- A monitoring/forecast system is required to address timing of the operations and required quantities (Pro-active Sand Management).

Alternative #2 – 550 m Detached Breakwater and a Groin

- This solution would protect the shoreline at Gibraltar Point.
- The groin will stabilize the shoreline to the east of GP (i.e. the shoreline between GP and the Intake Structure).
- Once the GP shoreline is stabilized, any future change in Hanlan's Beach shoreline could be addressed through focused sand management (Re-active Sand Management).

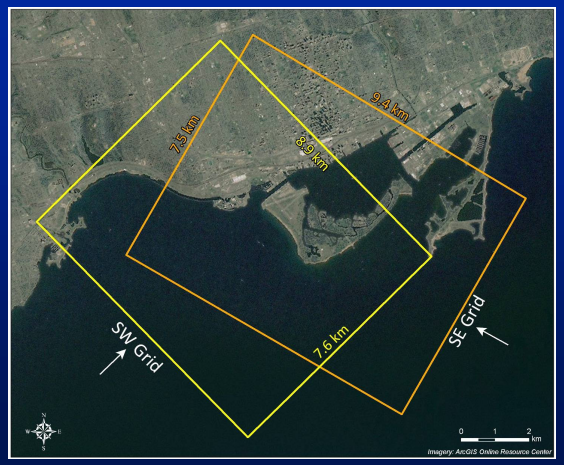


Sand Management

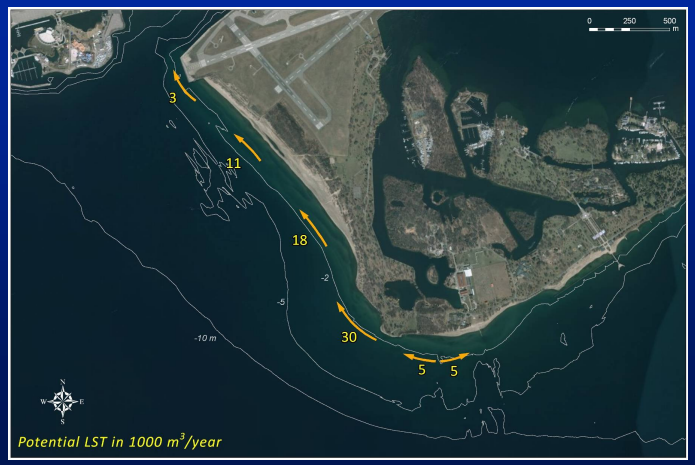
Numerical Modelling

- Numerical modeling of waves, hydrodynamics and sediment transport was completed using *HydroSed*.
- Two Grids were used with SW and SE orientations. Grid size was 7.5 m for both grids.
- The model was run for 110 easterly and 75 southwesterly representative wave conditions.
- Sediment transport rates were tabulated and used as look-up tables for long-term (40-year) transport rate calculations.
- Average long-term potential LST rates at various locations were obtained.

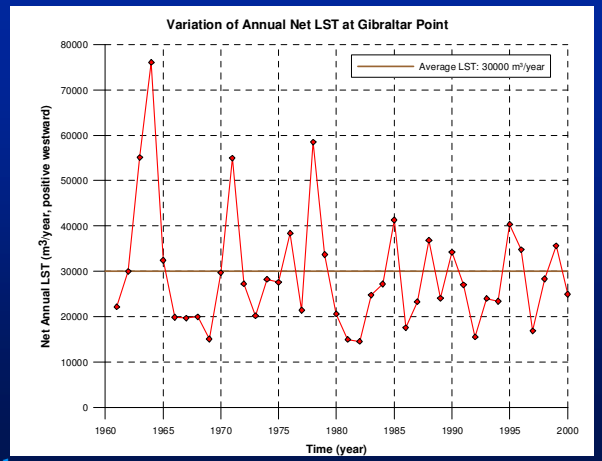
Model Grids



Longshore Sand Transport Rates (potential values)



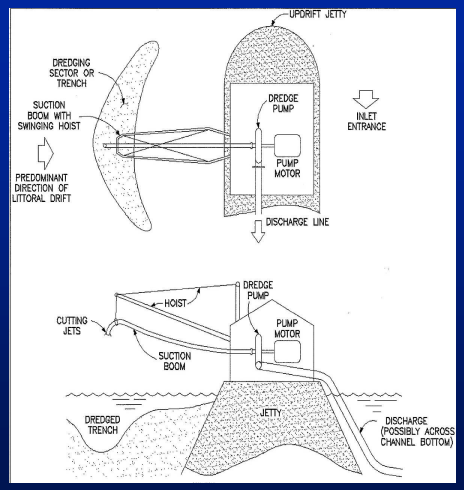
Annual variation of net LST at Gibraltar Point



Sand Management

- A pure sand management approach would have to on average deal with 30,000 m^3 of sand every year.
- The required sand volume differs from year to year and varies from 15,000 m^3 to 60,000 m^3 depending on the wave climate.
- A monitoring/forecast system is required to address timing of the operations and required quantities (Pro-active Sand Management to protect Gibraltar Point).

Sand Placement (Pure Sand Management)



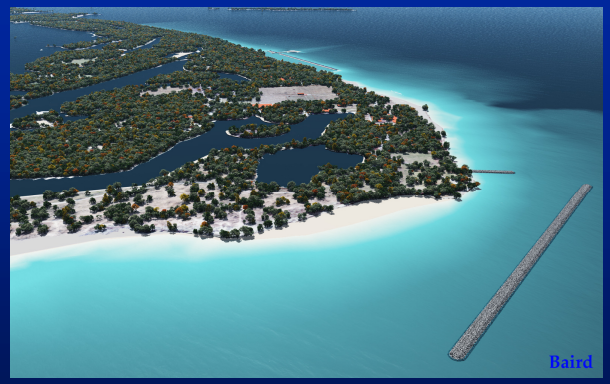
Sand Management Cost

- Using a discount rate of 3% over a time horizon of 50 years, a pure sand management approach would cost about $13,000,000 (present value).

Discount Rate	Present Value Cost
2%	$15,800,000
3%	$13,000,000
4%	$10,800,000

Detached Breakwater and a Groin with Focused Sand Management

550 m Detached Breakwater and a Groin

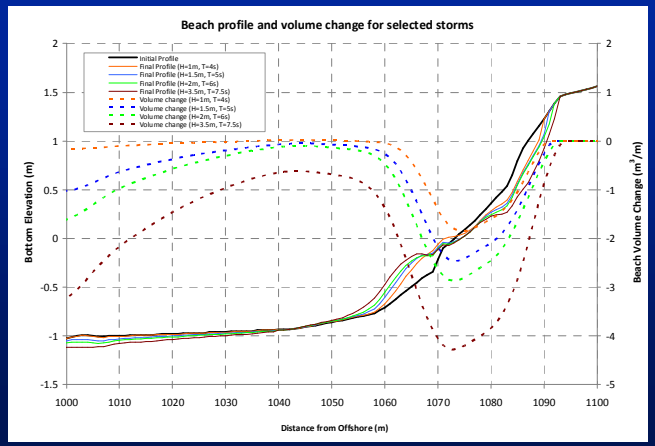


- Future change in Hanlan's Beach shoreline need to be addressed through sand management (Re-active Sand Management).

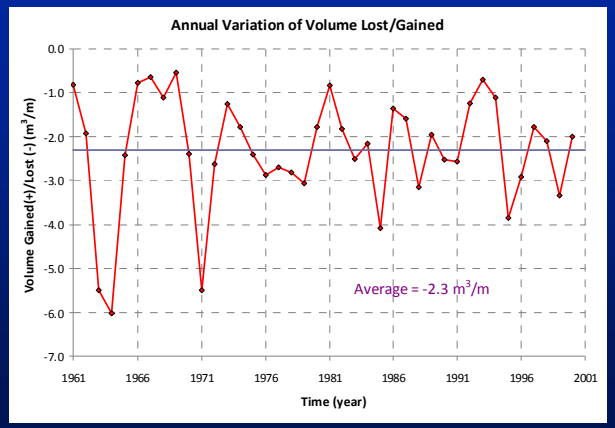
Numerical Modelling

- Numerical modeling of cross-shore sediment transport on Hanlan's Beach was completed using COSMOS.
- The model was run for 4 representative storm conditions.
- Volume loss from Hanlan's Beach were tabulated and used as look-up tables for long-term (40-year) volume loss calculations.
- Average long-term potential loss rates were obtained.

COSMOS Results



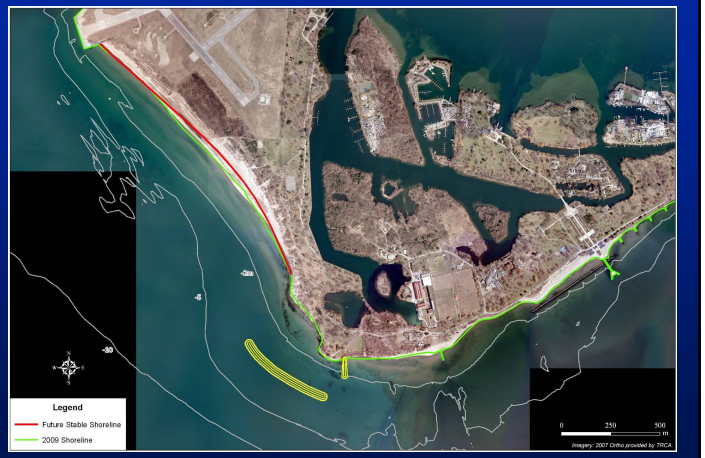
Annual variation of volume loss from Hanlan's Beach



Sand Management for Hanlan's Beach

- Assuming a length of 1,250 m, the predicted annual loss of sediment from Hanlan's Beach ranges from 1,000 m^3 to 6,000 m^3. On average it is expected that about 3,000 m^3 of sand will be annually lost from this beach.
- Eroded sand from Hanlan's Beach is expected to deposit in the Western Channel.
- Sand management for Hanlan's Beach would have to on average deal with 3,000 m^3 of sand every year on as-required basis.

Predicted future stable shoreline (without nourishment)



Sand Placement (Focused Sand Management, 15,000 m^3 every 5 years placed before the storm season i.e. in early September)

Cost

- Using a discount rate of 3% over a time horizon of 50 years, the proposed breakwater and groin with focused sand management would cost approximately $12,100,000 (present value).

Discount Rate	Present Value Cost
2%	$12,500,000
3%	$12,100,000
4%	$11,900,000

Comparison of Alternatives

Criteria	Stand-alone Sand Management	Breakwater and Groin with Focused Sand Management
Protection of Gibraltar Point	Yes	Yes
Minimizing impact on natural processes at Hanlan's Beach	Yes	Yes
Cost (PV at 3% discount rate)	$13,000,000	$12,100,000
Risk	Higher	Lower
Sand source	Multiple	Western Channel
Protection of existing infrastructure	Yes	Yes
Stabilizing the beach east of GP	Potentially	Yes
Creation of new public space	No	Yes
Operation and Maintenance	???	City

Risk components

- **Stand-alone Sand Management**
  - *Timing (be pro-active): It is impossible to predict the exact annual requirements. Have to assume the worst case scenario (i.e. 60,000 m^3/year)*
  - *Greater uncertainty of future budgeting ($500,000 per year)*
  - *Public perception?*
  - *Multiple sand sources due to larger volume, potential for introduction of non-native species*
  - *Less design certainty*
- **Breakwater and Groin with Focused Sand Management.**
  - *Less certainty regarding adverse impacts (on local scale)*
  - *Length of time required for beach nourishment and available operational windows*
  - *Impact of dredging on the sand source*
  - *Impact on habitat*

Conclusions

Conclusions

- Erosion at GP (shore and lakebed) provides on average about 14,000 m^3 to 18,000 m^3 of sand to the littoral system, most of it is transported northward and deposited on Hanlan's Beach.
- A pure sand management approach (Alternative #1) would on average have to deal with 30,000 m^3 annually. Actual erosion events, however, are expected to be episodic making it impossible to predict the exact annual requirements. Have to assume the worst case scenario (i.e. 60,000 m^3/year)
- Alternative #1 would cost approximately $13,000,000.
- A 550 m detached breakwater and a groin together with sand management focused on Hanlan's Beach (Alternative #2) would protect the shoreline at Gibraltar Point, stabilize the shoreline to the east of GP, and minimize impact on natural processes at Hanlan's Beach.
- Alternative #2 would cost approximately $12,100,000.
- The proposed two alternatives have similar costs. Alternative #1 has a higher risk as it requires significant budgeting commitments in the future.

TORONTO AND REGION Conservation
for The Living City

May 16, 2011

Steve Varga and Warren May
Ministry of Natural Resources
50 Bloomington Road West
Aurora, Ontario
L4G 3G8

Dear Mr. Varga and Mr. May:

Re: Gibraltar Point: October 6, 2010 Meeting with MNR Action Items

The letter is in response to the action items discussed during our meeting held with MNR at TRCA's offices on October 6, 2010. The two main action items resulting during that meeting included:

a) TRCA/Baird will identify all viable sources of sand along the Toronto Waterfront and evaluate it for its applicability and availability for reuse under the straight sand management approach.

RESPONSE: In response to this action item, please find the enclosed memo prepared by Baird that outlines all the sources of sand available along the Toronto Waterfront that was considered for a straight sand management approach. The memo concludes that local nearshore or offshore sources of sand do not have sufficient volume or suitable grain size and quality for ongoing, sustainable sand management at Gibraltar Point. As such, a straight sand management approach would require imported sand from other sources. This would involve a long-term (permanent) commitment to purchase sand of sufficient quality, size and quantity and transport it to Gibraltar Point. These on-going costs would far exceed the estimates provided to date for the straight sand management approach, which had previously assumed a locally available and readily accessible and free source of sand. In addition, excavating such a large volume of sand would have (i) significant environmental impacts on the selected source area and (ii) would have significant impacts related to Greenhouse Gas emissions, and municipal infrastructure given the associated transportation needs.

b) TRCA/Baird will examine how the two approaches (straight sand management approach vs. focused sand management approach) will influence the interim and long-term ecological community distribution on the hind dune area.

RESPONSE: TRCA and Baird met with the two independent volunteer experts on the Community Liaison Committee (CLC), Dr. Mary-Louise Byrne and Dr. Robin Davidson-Arnott, on December 1, 2010 to discuss this concern. A summary of that meeting has also been attached to this letter.

.../2

In general, both Dr. Bryne and Dr. Davidson-Arnott agreed with Baird's analysis that (i) the observed westward advance of Hanlan's Beach and the formation of transitional hind dunes was due to human expansion of the Toronto Island Airport, and (ii) Hanlan's Beach has since likely reached capacity. Given that the beach has reached capacity, the beach front will no longer migrate westward as a result of ongoing erosion at Gibraltar Point. With the cessation of the westward advance of the beach, the observed transitional hind dunes will shortly, or have already, begun to stabilize to an upland forested habitat, even under the Do Nothing alternative for the Gibraltar Point. As such, in order to maintain the observed transitional hind dune systems an active Parks Management program would be needed to ensure that the these features do not stabilize into an upland forest condition. Such a program would be undertaken separate from the proposed alternative outlined through the Gibraltar Point Erosion Control Project.

The independent experts did, however, agree with MNR's concerns that the observed beach raking activities undertaken by the Blue Flag Program were currently negatively impacting the water-beach-dune system. The experts suggested that there were ways to improve these management practices while still allowing for management of e-Coli levels along Hanlan's Beach. Again, these concerns involve management practices not associated with the proposed alternative outlined through the Gibraltar Point Erosion Control Project.

TRCA would be prepared to assist MNR in engaging Toronto Parks and Toronto's Blue Flag program to address these separate management issues, assuming funding is made available for TRCA participation.

TRCA has appreciated MNR's involvement throughout the Gibraltar Point Erosion Control Project Class EA over the last several years. With MNR's involvement, TRCA has undertaken:

- a comprehensive coastal process study that quantified the rates and causes of the observed erosion hazard;
- an extensive technical evaluation of the proposed solutions to address the observed erosion hazard;
- an overview of the unique ecological systems associated with Gibraltar Point and Hanlan's Beach;
- an in depth review of the history of these unique ecological systems and the sources for their impairment;
- an overview of potential sand sources available along the GTA waterfront that could potentially be used for a Straight Sand Management approach; and
- a detailed evaluation of the preferred alternative that would best meet the needs for protecting the shoreline to maintain the Island's form and functions, while ensuring for the continuation of a dynamic sand dune system along Hanlan's Beach.

Based on these extensive studies, TRCA and the City of Toronto, with the concurrence of our independent coastal experts on the CLC, have concluded that the preferred alternative as developed by Baird, is the best approach to proceed with the Gibraltar Point Project. The preferred alternative includes a Focused Sand Management Approach combined with the construction of a 550m long offshore emergent breakway and a 130m long nearshore groyne.

.../3

We trust that in undertaking these additional studies, we have met MNR's remaining concerns, and that MNR is satisfied with our conclusions as we move to Detailed Design for the Preferred Alternative.

As indicated above, TRCA would be pleased to arrange discussions between MNR, Toronto Parks and Toronto's Blue Flag Program to discuss management opportunities to address MNR's concerns pertaining to the long-term viability of the transitional hind dune systems, and the current e-Coli management practices along Hanlan's Beach.

If you have any remaining questions or concerns, please feel free to contact me at (416) 661-6600 (ext. 5230), or by email at kdion@trca.on.ca. Otherwise, I would like to instruct Baird to proceed to Detailed Design of the preferred alternative.

Yours Truly,

Kenneth M. Dion
Senior Project Manager

GIBRALTAR POINT PROJECT

Gibraltar Point Erosion Control Project:
Phase 2 – Coastal Engineering Study and Detailed Design
Technical Teleconference

Chair: Kenneth Dion

Wednesday December 1, 2010
1:00 p.m.

TELECONFERENCE SUMMARY

Teleconference Purpose:

- In response to MNR concerns, discuss likely impacts to "transitional hind dune habitat" as a result of breakwater and focused sand management option.

Key Outcomes:

- Effective beach management practices key to enhancing/maintaining natural beach-dune complex. These practices are independent of the proposed undertaking for the Gibraltar Point Project.
- Baird to assess Hanlan's Beach using aerial photographs and profile surveys to assess if beach progradation has reached or is nearing maximum extent based on hardpoints at airport runway and Gibraltar Point.

Present on Call:

Dr. Mary-Louise Byrne	Wilfrid Laurier University
Dr. Robin Davidson-Arnott	University of Guelph
Ken Dion	Toronto and Region Conservation
Mark Kolberg	Baird and Associates

INTRODUCTIONS

Ken Dion (KD), Senior Project Manager, TRCA, welcomed and thanked the participants for participating in the teleconference. The teleconference was held to discuss issues arising from a meeting held October 6, 2010, with MNR representatives Steve Varga (SV) and Warren May (WM), City of Toronto representative Bill Snodgrass (BS), TRCA representatives Nick Saccone (NS), Laura Stephenson (LS), and KD, and Baird representatives Mohammad Dibajnia (MD) and Mark Kolberg (MK).

1.0 SUMMARY OF ISSUE FOR DISCUSSION ARISING FROM OCTOBER 6, 2010 MEETING

At the October 6, 2010 meeting, Baird summarized that the breakwater/sand management approach will maintain the existing footprint and function of the dynamic dune and beach area along Hanlan's Beach. The straight sand management approach will approximate the current growth and function of the dynamic beach and dune area along Hanlan's Beach until the beach reaches its maximum capacity in relation to the hardened point at the Toronto Island Airport (which is nearly at capacity).

SV had expressed concerns regarding the potential loss of dynamic beach front and the potential impact on the extent of hind beach transitional areas of open marram grass dunes and wet meadow communities. His concern was that the extent of transitional hind beach area under the breakwater/sand management approach will transition to a more constant forested condition sooner than the straight sand management approach.

Baird noted that once Hanlan's Beach reaches capacity under the straight sand management approach (meaning no further significant westward advancement of the beach front into the lake), the transitional hind beach habitat area is also anticipated to decrease as well as it becomes more forested.

2.0 OBSERVATIONS OF HANLAN'S BEACH BY MLB AND RDA

Following CLC Meeting #2 on June 16, 2010, Mary-Louise Byrne (MLB) and Robin Davidson-Arnott (RDA) accompanied SV for a site walk at Hanlan's Beach. MLB and RDA reported the following observations:

- They were struck by how wide the beach was and that it appeared as if the backshore dunes were "divorced" from the wave activity due to the extensive beach width.
- Both suggested that beach raking might be partly responsible for keeping the water-beach-dune system artificially separated; beach raking disturbs/destroys emerging vegetation.
- The artificially wide beach may also promote more than "normal" wind driven sand transport off the beach to the backshore – this would depend on the moisture content of the beach sand.

- It was also suggested that the rate of sand supply to Hanlan's Beach might be faster than the rate of vegetation transition.

MK noted that at the October 6, 2010 meeting with MNR and City staff, the City stated that beach raking was required by Toronto Public Health as a necessary and effective way to reduce e-coli loadings to beaches; safe e-coli readings are an important public health issue and a component of the Blue Flag program. The City acknowledged that there may be scope for improvements to the existing beach management practices. TRCA offered to arrange for discussions between MNR and the appropriate City Staff to discuss possible modifications to current beach management practices that will allow for continued public use of the beach, while improving the ecological functions of the water-beach-dune system. TRCA also emphasized that such beach management discussions are separate and independent to the current Gibraltar Point Project.

3.0 DISCUSSION

- MK provided brief background of expansion and filling in the area of the airport runway – south wall of the Western Channel was extended c. 1938-1940; by the early 1960's, the south wall was enlarged to create a "headland-type" structure, but the length offshore remained similar; a large part of the area to the south was filled and graded. As a result of these historical human interventions, longshore transport has moved sand northwest from Gibraltar Point resulting in accretion in the backshore area and artificially accelerated rates of progradation of the beach line westward. MK noted that Hanlan's Beach may be close to or already have reached capacity, i.e., bypassing at the north end into the Western Gap has been occurring for some time. RDA questioned if south end had reached capacity. Baird could check survey profiles.
- RDA asked about plan form of shoreline if north "hardpoint" (airport runway protection) is maintained and Gibraltar Point is maintained in present location (through protection or otherwise) (i.e., a log-spiral shape). MK replied that a figure had been presented at CLC Meeting #2 that depicted the estimated future shoreline position with an offshore breakwater in place at Gibraltar Point and no sand management – it showed minimal change of the shoreline at the north end, some retreat of the shoreline in the mid-section and little change at the south end.
- RDA asked if other alternatives were considered, such as allowing the Point to erode. MK explained that a figure had also been presented at the CLC Meeting #2 that depicted the long-term shoreline position if Gibraltar Point continued to erode but the shoreline was anchored by the water intake structure to the east and by the airport runway – it showed a loss of much of the Area of Natural Scientific Interest (ANSI), the Environmentally Significant Area (ESA), the provincially significant wetland as well as a significant amount of public park space. MK noted that through the Environmental Assessment (EA), the areas at great risk of erosion behind the Point were considered very valuable, including provincially significant wetland, AINSI, ESA and public park space. The EA examined the Do-Nothing option and it was not selected as the preferred

approach. As a result of EA, the detail design project objectives are to control erosion of Gibraltar Point and mitigate the impacts on the natural processes at Hanlan's Beach.

- KD noted that with the offshore breakwater and focused sand management option the emphasis has been on retaining the existing area of the dynamic beach face. SV was concerned that by halting westward progradation of the beach front, we will gradually lose the area of land that is progressively transitioning from active dune to stable upland forest. Once beach advancement halts, SV contends that over a couple of decades or so, the transitional zone will grow in, stabilize and become upland forest once beyond the active dune face area.
- MK suggested that at this point in time in the evolution of the beach-dune system at Hanlan's Beach, stabilization of the prograding transitional vegetation zone may have already started and the offshore breakwater and focused sand management option will not dramatically alter the existing establishment of vegetation.
- MLB and RDA agreed that Hanlan's Beach (beach-dune complex) could benefit most from effective beach management practices.

4.0 DATA GAPS AND NEXT STEPS

Using aerial photographs and profile surveys, Baird could assess the rate of beach progradation over the last 40-50 years and estimate how far we are from a stable beach condition at Hanlan's Beach, particularly the south end, based on hardened points at the Toronto Island airport in the north, and at Gibraltar Point in the south. This information could be used to assess the amount of time remaining before the westward progression of dunes would likely halt upon reaching a new stable dynamic condition (which would also result in the eventual loss of transitional habitat anyways).

In advance of those analyses, it is suspected that the time is limited for those transitional habitats. If the resulting artificially-created transitional habitats do hold significant ecological value, this would appear to be a long-term Parks management issue, whereby vegetation management practices in the current transitional zones would be required, whether or not the Gibraltar Point Project proceeds. TRCA are prepared to engage Toronto Parks and MNR in discussions to maintain that transition zone through a separate planning process from the current Gibraltar Point Project, if deemed necessary, and if funding is made available.

Similarly, TRCA would be prepared to engage Toronto Parks, Toronto Water, Toronto's Blue Flag Program and MNR in discussions to enhance current beach management practices to improve the ecological connections between the water-beach-dune system, while still allowing public use of the beach. These discussions would again be through a separate funding and planning process. TRCA will look to MLB and RDA for input on effective beach management practices through the Gibraltar Point Project to initiate those discussions.